R E P O R T R E S U M E S

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PROGRAMED INSTRUCTION AND TEACHING MACHINES--A NATIONAL DEMONSTRATION-EXHIBIT.

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A NATIONAL DEMONSTRATION EXHIBIT OF PROGRAMED INSTRUCTION AND TEACHING MACHINES WAS CONSTRUCTED, BASED ON THE PRINCIPLES OF PROGRAMED INSTRUCTION. THE EXHIBIT WAS DISPLAYED AT 44 LOCATIONS AND WAS VIEWED BY OVER 100,000 PEOPLE. THE MAJORITY OF THE POPULATION ATTENDING THE EXHIBIT CONSISTED OF TEACHERS, SCHOOL ADMINISTRATORS, AND STUDENTS WHO INTENDED TO ENTER TEACHING AS A PROFESSION. PROFESSIONALS, SERVING AS CONSULTANTS, GAVE SEMINARS AND LECTURES AND ANSWERED QUESTIONS OF VISITORS AT EACH TOUR SITE. AN EXHIBIT GUIDE CONTAINING INTRODUCTORY MATERIALS AND A BRIEF BIBLIOGRAPHY ON PROGRAMED INSTRUCTION WAS ALSO AVAILABLE. THE IMPRESSIONS OF THE VIEWERS, AS DETERMINED BY AN ATTITUDE QUESTIONNAIRE, WERE FAVORABLE TOWARD THE EXHIBIT. (AW)

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The Center for Programed Instruction, Inc.
Institute for Educational Technology
Teachers College
New York, New York

Programed Instruction and Teaching Machines:

A National-Demonstration Exhibit

Final Report to Contract OE 2-16-031

March 1964

Bureau of Educational Research and Development
U.S. Office of Education
Department of Health, Education, and Welfare
Washington, D.C.

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Final Report to Contract OE 2-16-031

Abstract

This report is tendered as a final description of efforts undertaken by The Center for Programed Instruction, Inc. for the U.S. Office of Education under contract OE 2-16-031. The contract was funded under Part B of the U.S. Office of Education's Title VII Program, calling for the dissemination of information on new educational media. The efforts undertaken consisted of designing, constructing, and maintaining a touring demonstration-exhibit on programed instruction and teaching machines.

The exhibit was set up at forty-four locations and was attended by approximately 100,000 people. In addition to administering the tour of the exhibit, the Center provided professionals to serve as consultants to give seminars and lectures, and to answer the questions of visitors at each tour site. An Exhibit Guide containing introductory material and a brief bibliography on programed instruction was also prepared. Over 300,000 of these Guides were distributed, indicating the extent of interest shown in this new field.

The project was unique in two respects: it was the first exhibit prepared utilizing the principles of programed instruction; and it was the first time the U.S. Office of Education had undertaken to contract for such an extensive exhibit. As a result this report contains a description of the rationale for the preparation of the exhibit, a statement of the efforts of the personnel associated with the exhibit in terms of the anecdotal responses of persons attending, and the amount of unsolicited publicity received. In addition, based on an attitude questionnaire distributed at the exhibit, data relevant to the attitudes of the attending population are presented.

Final Report to Contract OE 2-16-031
Abstract

The anecdotal evidence and the data collected by means of the attitude questionnaire suggest a great deal of enthusiasm toward this new medium and also the feasibility of using such a vehicle for the dissemination of information to educators.

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Final Report to Contract OE 2-16-031

Programed Instruction and Teaching Machines:
A National Demonstration-Exhibit

Introduction

The United States of America, acting through the Associate Commissioner, Bureau of Educational Research and Development, Educational Media Branch, U.S. Office of Education, Department of Health, Education, and Welfare, contracted with The Center for Programed Instruction, Inc. to provide the design, construction, management, and maintenance of a demonstration-exhibit whose purpose would be the dissemination of information pertaining to those new educational techniques falling under the generic heading of "Programed Instruction and Teaching Machines."

To this end the Center for Programed Instruction provided to the best of its ability efforts necessary for the success of the U.S. Office of Education's aim in "disseminating information concerning new educational media to state or local agencies for use in their public elementary or secondary schools or to institutions of higher education" as authorized in Section 731 (3) of Public Law 85-864.

II. Background

"Programed instruction and/or teaching machines" refers to a development of behavioral technology that has gained wide recognition by virtue of its demonstration of effectiveness as a teaching aid.

"Behavioral technology" is a synthesis of efforts between learning psychologists and educators which provides an approach to the development of a technology in education. Its initial and, so far, most effective resultant is "programed instruction."

The term "programed instruction" refers to a specialized means of self-instruction whose development is based on the principles of learning theory derived from experimental research. Its foundation lies in the control over the interaction between the learner and the materials to be learned. While in appearance it resembles familiar question and answer items, the sequence of these items or frames has been so constructed that it serves to lead the student to mastery of the subject with minimal error.

"Teaching machines" is the glossary term reserved for the devices that display the items and allow for learner interaction required by the program. Numerous types of machines have been developed. They vary from simple devices priced under $5 to very complex equipment ranging up to $20,000.

In 1962 programed instruction had begun to be used on a limited basis by school systems in the United States. Research evidence had been gathered indicating the value of programs in providing an aid to the solution of academic problems which still continue to beset our educational institutions; that is, programed instruction had been shown to be a successful aid in situations where traditional methods had not provided its student population with the minimal achievement

necessary to meet the intellectual demands of the culture. In addition, it had been proven to be effective as an enrichment program for the high achiever.

Three conclusions appeared the rule where research utilizing programed instruction had been attempted: (1) it decreased the time required to learn; (2) it resulted in more homogenous learning patterns independent of IQ; and (3) it freed the teacher from many of the rote responsibilities typical in a traditional system and allowed for more time to practice the art of teaching.

III. The Problem

In examining the change in the number of schools testing or using programs of instruction as a function of the 1958-61 period, it was apparent that the number was rising dramatically with each succeeding year. Hence, it was evident that provision for the dissemination of adequate information both to educators and to the lay populace was of paramount importance. This was particularly true in view of the cavalier treatment this new method was receiving in the popular press. Such articles as "Next Year's Teacher, A Robot" and "Your Child and the Teaching Machine" had already generated a host of antithetical attitudes on the part of educators and parents. Therefore, the demonstration-exhibit on programed instruction was conceived "for the benefit and instruction of the U.S. Office of Education and other governmental personnel, visiting educators, and for visitors in general, and for educators and other citizens in general."

IV. Exhibit Design

At the onset, when this project was in its preliminary planning state, a great deal of consideration was given to the various possibilities for disseminating information on programed instruction. Publications, conferences, and other typical dissemination techniques were considered and eliminated. It was only after much thought that the obvious presented itself; namely, the provision of a learning environment which in itself demonstrated the new technique. Hence, the idea of a programed exhibit.

Procedures necessary to the development of a program in any given content area were followed in the development of this exhibit.

A. Content Specification

Consideration of the areas upon which to present a comprehensive view of the field resulted in the specification of the following categories: A Program on Programed Instruction, *Teaching Machines*, *School Usage of Programed Instruction*, and a Library of Academic Programs.

B. Population Identification

The identification of the intended population for the exhibit was based upon the premise that schools would be the greatest users of programed instruction. The exhibit was therefore to be directed to a primary target population consisting of school administrators and educators. Further consideration led us to add students intending to enter the teaching profession to this primary group. (The population

provided one of the criteria for the selection of the host institution, i.e., that the largest number of possible attendees be from one of these categories.) Projects funded under the Title VII Program require that their product be available for general use, hence the exhibit had to be developed in such a way as to insure understanding by any interested parties that might enter the exhibit. This required a more basic level of development since it would not be possible to preselect the population on the basis of previously acquired knowledge.

C. Development of A Program on Programed Instruction

The Program on Programed Instruction was designed to provide educators and the lay populace with an understanding of how programed instruction works without requiring prior knowledge on their part of the technical terms used by the field.

The frames making up the program elicited active responses on the part of the attendees. By means of these responses we were able to provide control over the interaction between the attendee and the material he was to comprehend. Control of this active behavior also enabled us to regulate the traffic flow pattern through the exhibit.

The program that was used during the first appearances of the exhibit was the result of innumerable attempts at testing paper simulations of the intended exhibit. However,

the program was further revised throughout the extent of the exhibit's tour as we became more familiar with the behavior of the visitors in the real situation. The program was descriptive of both the linear and branching techniques used in instructional programing. Our initial frame, in addition to being a branch with the program, served as a selection device which allowed those visitors who had prior knowledge of programed instruction ready access to those sections of the exhibit they were most concerned with.

Subsequent testing and observation resulted in several changes to the version of the program which appears in Appendix A. In particular, a brief movie showing children using programed instruction was added as frame 2. The question in frame 1 required a NO response if the attendee had not had prior experience with programed instruction. NO, of course, is considered an undesirable response from the viewpoint of the visitor. Providing the viewers with a familiar experience in the midst of this unfamiliar setting, served as a reinforcement for selecting the NO branch and resulted in an increase in the number of people going through the Program on Programed Instruction. This modification was of particular importance as it increased the probability that the uninitiated would learn about programed instruction. This understanding was essential for the intelligent comprehension of the rest of the materials contained in the exhibit.

The program concerned itself with making clear the following important concepts in programed instruction:

a. active responses

b. relevant questions

c. sequencing

d. developmental testing

e. branching

f. the distinction between programed instruction and teaching machines

D. Teaching Machines Area

This segment contained representative examples of the kinds of devices available commercially. Selected for display were a film device demonstrating intrinsic or branching programing (AutoTutor Mk 11); a device using film which presented examples of linear programing (Mast Teaching Machine); and a device using paper rolls which demonstrated the use of both linear and branching techniques within the same program (MTA 100 Scholar). These devices were selected according to two criteria: that they did in fact demonstrate the techniques of programing in present use; and that they be mechanically reliable. In all three cases our expectations were borne out, despite the fact that most visitors to the exhibit were more concerned with trying to demonstrate machine failure than with viewing the material being presented.

The machines were repackaged so that they were unrecognizable as we wanted no possibility of the exhibit being used for

the purposes of commercial exploitation.

In addition to the three teaching machines, slides of those machines that were commercially available were displayed through the use of a Kodak Carousel slide projector and a Spindler Sauppe Random Access slide projector. Each slide contained information concerning the device's capabilities, cost, and address of the manufacturer (see Appendix B).

E. School Usage of Programed Instruction

This section of the exhibit contained a pictorial description of the introduction and use of programed instruction in the Ulster County school system. Ulster County was selected particularly because of the way in which they proceeded during their initial contact with programed instruction. They began by providing in-service training for teachers prior to program use, and by experimentally validating the effectiveness of various programs before attempting to use them on a large scale within the school system.

Included within the Ulster County display was a continuous loop tape recording of comments made by teachers with extensive experience in programed instruction. The section also contained a brief overview of some of the research applications which were at that time being undertaken in school settings, as well as a flow chart showing the steps necessary to prepare a successful program.

F. Library of Academic Programs

In this section copies of existing programs were made available to the visitors. These programs were provided without charge by their publishers (see Appendix C). The exhibit, through the

generosity of the publishers concerned, was able to maintain an up-to-date library throughout the extent of the exhibit's tour. This was a particularly magnanimous gesture as we found that viewers usually removed from 10 to 20 per cent of the programs at each location, thus necessitating an almost constant flow of programs from the publishers.

In addition to the exhibit, it was decided to provide a pamphlet to be distributed at each tour site. The Exhibit Guide which resulted briefly described programed instruction and contained a short bibliography on the subject. Included in the Guide was an attitude questionnaire which was used to evaluate the attitudes of the visitors toward the exhibit (see Appendix D).

V. Exhibit Construction

Our considerations of the problems involved in disseminating information about programed instruction resulted in our specifying the need for a programed exhibit containing information on programed instruction (provided by the Program on Programed Instruction), information on the use of programed instruction, samples of teaching machines, and a library of academic programs. Sufficient materials were collected to provide the necessary information for a comprehensive overview of the field. The ideas generated at the Center were then submitted on a bid basis to various industrial design organizations and designers of industrial shows. Dramaturgy, Inc., of Cleveland, Ohio, provided both the lowest bid and the most imaginative ideas.

The designers at Dramatury, along with CPI personnel, tested and revised design after design. Finally these efforts were rewarded in the form of a flexible walk-through exhibit built of aluminum and wood. The entire exhibit could be set up in an area of 1000 square feet. The design allowed for maximum flexibility in the ways in which it could be set up given the 1000 square feet, and, in the course of the tour, the exhibit was housed in classrooms, gymnasiums, ballrooms, corridors, in one case under a circus tent, and in sunny California, outdoors.

VI. Provision for Seminars and Lectures

In considering the totality of an educational experience such as was to be presented by the demonstration-exhibit, it became apparent that there would be a need for professional personnel capable of augmenting the information contained in the exhibit. Our decision to provide professionals with considerable experience in programed instruction to travel to each location was of great value to the host institutions. In the majority of cases, local teacher and administrator meetings were scheduled to coincide with the visit of the exhibit and with CPI staff members serving as primary resource persons at these meetings. In addition, local school systems were encouraged to send groups of teachers to visit the exhibit. These people also availed themselves of the professional help either in the form of hastily organized seminars or by individual consultation. Further efforts consisted of providing lectures to graduate and undergraduate students when possible.

The effectiveness of this provision has been borne out by the many comments in letters commending these efforts (most of which are on file at the Educational Media Branch), and by the distances that many administrators and teachers traveled in order to participate in the seminars (in some cases as much as 400 miles).

Further proof of the effectiveness of the professionals are letters which continue to arrive at the Center from various conventions and teacher-training institutions requesting the use of the persons accompanying the exhibit as resource personnel and consultants to their meetings.

VII. The Exhibit's Tour

Over 500 requests for the exhibit were received. While all of the requests were of merit, it was possible to visit only forty-four locations in the time period allotted by the contract. Appendix E presents the schedule of the tour. The majority of the locations were universities and school systems rather than conventions as we found that the proper milieu greatly enhanced the impact of the exhibit. At schools and universities people came prepared to demand information rather than to exhibit what we have come to know as convention behavior.

The locations were chosen on the basis of what was most expeditious in terms of lack of previous exposure in an area and financial requirements resulting from transporting the exhibit from site to site. In addition, when there were several requests from one area, the depth of the involvement which the institution promised to provide in terms of attracting educators and other interested parties helped in determining

the selection of the host institution.

Examination of Appendix E will indicate the comprehensiveness of the tour with respect to geographic location. An extension of this contract had been considered which would have allowed us to visit those continental states not covered, as well as to answer requests from Alaska, Hawaii, and Puerto Rico.

VIII. The Attending Population

The data describing the attending population were gathered in two ways. First, we solicited names of people visiting the exhibit by requesting that they sign a guest list. In addition to their names, we also requested that they provide us with their job category and address. We estimated that an average of 80 per cent of the attendees at each location signed the guest list, though variations on this figure were high. The total number of signatures, however, amounted to 79,362.

The second method whereby data were gathered was by use of the attitude questionnaire contained in the Exhibit Guide. Data from these questionnaires were collected at thirty-three locations. The number of attendees who filled in the questionnaire was considerably less than the number signing the guest list. The total number of questionnaires collected amounted to 16,011.

The questionnaires were coded, card-punched, and verified in order that tabulations be performed by computer. The guest lists were counted by hand and unverified.

Table 1 presents a breakdown of the people attending the exhibit according to job category. It should be noted that it was not possible

Table 1

Percentage Classification of Attendees to the National Demonstration-Exhibit on Programed Instruction and Teaching Machines presented according to Job Category

	Teachers				School Administrators	School Psychologists or Counselors	Students	Others in Education	Others not in Education
	Elem.	Jr. High	H.S.	College					
Attitude Questionnaire 33 locations (N = 16,011)	12.4	6.2	10.1	12.1	13.2	1.5	26.7	5.1	12.7
Guest Lists 44 locations (N = 79,362)		37.7			15.6	2.4	27.1	3.9	13.3

to determine from the guest lists the type of teacher, and , as a result, in this category all "teachers" are represented by a single figure.

One should observe that the breakdown of teachers finds elementary through high school teachers outnumbering college level personnel by a factor of only 2-1/2 to 1. This suggests a great deal of interest on the part of university faculty members since the ratio is disproportionate to their relative number in the national population.

The group labeled "school administrators" is comprised of superintendents, assistant superintendents, principals, and assistant principals, as well as college administrators (presidents, deans, and assistant deans).

The vast majority of those listing themselves as students also indicated their major field of study to be education. This is as we had anticipated as the invitation from a host institution most frequently eminated from the Department or College of Education of the institution.

Included in the category "other educational occupations" are teachers in technical and business schools, curriculum coordinators, consultants, audio-visual specialists, librarians, researchers, and industrial training specialists.

In addition to the aforementioned vocations, many people of diverse interests ranging from plumbers to physicians also attended the exhibit in an effort to familiarize themselves with this new educational technique. All persons who attended but who were not concerned directly

with the field of education are incorporated under the category labeled "others." It is quite evident, upon examination of the percentage breakdown, that our initial goals in terms of target population were realized. Sixty-one per cent of the total population were directly concerned with education either in the form of teaching or administration, and 26 per cent were students, the vast majority of whom indicated their professional goal to be teaching.

IX. Publicity

This project has demonstrated the practicality of utilizing an exhibit for the purposes of disseminating information about new educational media and, thereby, of implementing the provisions of the U.S. Office of Education's Title VII Program. However, a supplementary capability of any effort sponsored by the Office of Education should be to inform the public about the Office's function. Knowledge of the services and capabilities of this branch particularly in terms of general dissemination, would be of inestimable value. The novelty and effectiveness of an exhibit such as the one undertaken by the Center was its ability to provide a service to the Office of Education in terms of general promotion of the Office's function.

The Educational Media Branch has already on file (reference: supplement to Preliminary Report, Contract OE 2-16-031, August 1963) newspaper clippings collected during the course of the exhibit's tour. As no clipping service was employed, these items were amassed during the time of the exhibit's stay at each city. In addition to the clippings, letters received at the Center and at the Office of Education made us aware that at least two wire

services picked up and followed through with stories concerning both programed instruction and Public Law 85-864 which provides for the dissemination of information on new educational media. Further publicity was provided by the professionals accompanying the exhibit who made several appearances on radio, and on commercial and educational television. These appearances are too numerous to list, though a file of reference exists at the Center for Programed Instruction.

On the basis of our experience, it appears that provision to inform the public about the U.S. Office of Education has been severely neglected, and we would recommend that inclusion of statements concerning the function of this Office be formally considered as part of Office of Education contracts.

X. Results of Attitude Questionnaires

In an effort to assess the impact of the exhibit upon the viewing public, an attempt at data collection was carried out. Toward this end, a preference or attitude questionnaire was included in the Exhibit Guide distributed at each site. The primary function of the attitude questionnaire was to determine: (1) the distribution of professional categories of the attendees (reference: Section V of the Guide questionnaire); and (2) the particular attitudes of the attendees toward information presented in the various sections of the exhibit. The format of the questionnaire allowed for the observation of these attitudes. Following is a description of the data collected during the tour of the National Demonstration-Exhibit on Programed Instruction and Teaching Machines.

Questionnaire cards in the amount of 16,011 were collected. This constitutes approximately 14 per cent of the estimated viewing population. Table 2 presents a summary of the results of the preferences of the attendees toward various sections of the exhibit. As had been expected, the viewing population was extremely enthusiastic in their feeling toward the exhibit.

That section of the exhibit which elicited the most unfavorable response was Section B, the Teaching Machines Area. It was recognized, before the exhibit was constructed, that the attitudes of the individuals toward teaching machines would in effect make this section the most controversial. It is our opinion that this response was not the function of the information presented in this section but was the result of predetermined attitudes. Despite the fact that a great effort was made in the Program on Programed Instruction to make clear the distinction between programed instruction and teaching machines, it was not sufficient to overcome the strong negative attitudes engendered by prior publicity put forth before the public by newspapers and magazine articles. Quite frequently we heard teachers mutter "where are those machines that are to replace us?" We also watched people push buttons on the machines to demonstrate that the machines could be broken and therefore "certainly could not be a replacement for the teacher."

While the segment of the population representing this attitude was relatively small, their attitudes were so strongly antithetical that we were unable to make clear to them the most important part of our information; namely, that machines were devices for the presentation of programs and, hence, were to be used as an adjunct to the

Table 2

Summary of the Results of the Preferences of the Attendees toward Various Sections of the Exhibit

		Extremely Favorable	Favorable	Neutral	Unfavorable	Extremely Unfavorable
A	Program on Programed Instruction (N = 15,868)*	29.1	51.9	15.7	2.6	.7
B	Teaching Machines (N = 15,944)*	21.2	44.2	23.8	8.8	2.0
C	Use of Programed Instruction in Schools (N = 15,788)*	18.9	45.3	29.1	5.7	1.0
D	Library of Academic Programs (N = 14,940)*	30.0	46.0	19.4	3.6	1.0

*differences in N result from incomplete questionnaires

teacher. Paradoxically, many of these same people viewed programed instruction with extreme favor, creating in their own minds a dichotomy between programs presented via texts and those same programs presented via machines.

Sections A and D, A Program on Programed Instruction and the Library of Academic Programs, respectively, drew the most favorable response. This, too, was to be anticipated as these were the most meaningful elements of the exhibit. Furthermore, since Section A provided many of the viewers with sufficient information to deal with the materials presented in Section D, it was to be expected that the attitudes would closely resemble each other.

Table 3 provides a summary of the attendees preferences for the various sections of the exhibit according to job category. Four 9 x 5 tables were tested for between category differences by using an extension of a median test (reference: Segal, Non-Parametric Studies, McGraw-Hill Book Company, New York, 1956). The hypothesis that there is a difference in attitude as a function of job category was tested. The associated probability for all four tables was not significant, leading us to reject the hypothesis.

The data presented in table 3 indicate that all people attending the exhibit showed the same attitudes toward the various sections of the exhibit independent of their job category. It is our belief that this does not truly reflect the positions of the various groups toward the exhibit but instead, especially since all groups evidenced extreme favorability toward the exhibit, reflects a positive attitude

Table 3

Summary of the Results of the Preferences of the Attendees toward Various Sections of the Exhibit according to Job Category

Section A
A Program on Programed Instruction

	Extremely Favorable	Favorable	Neutral	Unfavorable	Extremely Unfavorable
Teacher, Elementary (N = 1835)	49.6	44.1	4.4	1.3	0.6
Teacher, Junior High (N = 960)	26.2	52.5	18.0	2.4	0.9
Teacher, High School (N = 1605)	26.7	54.0	18.3	0.7	0.3
Teacher, College (N = 1712)	26.0	52.7	16.3	4.2	0.8
School Administrator (N = 2052)	24.3	56.5	16.1	2.9	0.2
School Psychologist or Counselor (N = 224)	28.7	47.6	22.0	1.1	0.6
Student (N = 4240)	33.5	49.7	14.6	1.6	0.6
Others in Education (N = 832)	25.7	59.0	11.8	2.7	0.8
Others not in Education (N = 2004)	34.6	46.1	14.3	3.9	1.1

more . . .

Table 3 (continued)

Section B
Teaching Machines

	Extremely Favorable	Favorable	Neutral	Unfavorable	Extremely Unfavorable
Teacher, Elementary (N = 1944)	21.7	46.5	26.0	3.9	1.9
Teacher, Junior High (N = 953)	20.3	44.6	29.1	3.1	2.9
Teacher, High School (N = 1597)	21.7	47.4	24.8	5.4	0.7
Teacher, College (N = 1848)	15.0	44.7	27.9	10.1	2.3
School Administrator (N = 2068)	10.6	45.9	30.1	11.3	2.2
School Psychologist or Counselor (N = 224)	15.7	41.0	30.4	9.3	3.6
Student (N = 4232)	31.3	42.6	18.1	6.3	1.7
Others in Education (N = 816)	16.1	42.3	33.7	5.0	2.9
Others not in Education (N = 1947)	24.1	43.6	23.1	7.1	211

more . . .

Table 3 (continued)

Section C
Use of Programed Instruction in the Schools

	Extremely Favorable	Favorable	Neutral	Unfavorable	Extremely Unfavorable
Teacher, Elementary (N = 1941)	18.3	48.1	27.2	5.1	1.3
Teacher, Junior High (N = 964)	22.7	39.1	31.5	5.7	1.0
Teacher, High School (N = 1572)	18.4	42.6	31.3	7.0	0.7
Teacher, College (N = 1860)	14.9	44.3	33.8	5.4	1.6
School Administrator (N = 2128)	15.5	52.1	28.3	3.7	0.4
School Psychologist or Counselor (N = 240)	14.4	52.9	25.1	4.1	3.5
Student (N = 4236)	22.4	43.5	27.1	6.0	1.0
Others in Education (N = 808)	21.3	48.7	22.0	6.2	1.8
Others not in Education (N = 1908)	23.8	43.0	27.6	4.1	1.5

More . . .

Table 3 (continued)

Section D
Library of Academic Programs

	Extremely Favorable	Favorable	Neutral	Unfavorable	Extremely Unfavorable
Teacher, Elementary (N = 1796)	47.6	45.3	4.0	2.3	0.8
Teacher, Junior High (N = 920)	23.6	55.5	18.7	1.6	0.6
Teacher, High School (N = 1554)	24.3	48.9	22.0	4.1	0.7
Teacher, College (N = 1705)	26.1	43.1	27.9	2.1	0.8
School Administrator (N = 1984)	28.0	52.4	17.1	1.7	0.8
School Psychologist or Counselor (N = 220)	30.4	48.7	15.9	3.2	1.8
Student (N = 4103)	31.3	46.9	16.8	4.5	0.5
Others in Education (N = 765)	27.7	54.3	14.6	2.7	0.7
Others not in Education (N = 1896)	32.0	45.3	18.6	3.6	0.5

merely toward the existence of such efforts.

Table 4 presents the results of the third section of the attitude questionnaire. In this section the attendees were asked what part of the exhibit they liked most/least. It should be noted that the most extreme reaction was toward Section B, Teaching Machines, reflecting the aforementioned biases we had noted at the exhibit.

Section C, School Usage of Programed Instruction, which appeared to be the least liked portion of the exhibit, may have reflected a lack of interaction between the attendee and the material he was viewing. Section C contained a good deal of copy and required very little in the way of active responses. These attitudes compare with studies of other exhibits (reference: Wise, Boutorline & Lee, IBM File Report, New York), which indicated that dislike preferences were negatively related to the amount of reading required by the display.

We were extremely gratified by the low dislike score achieved by the Program on Programed Instruction. This score, we felt, reflected the success of utilizing the underlying principles of programed instruction to present information to large groups.

Table 5 presents data concerning subjects' attitudes toward the inclusion of additional material in the exhibit. Part A asked the question "Are there any phases of programed instruction that were not covered, but should have been?" Part B asked "Are there any phases of programed instruction that were not covered as fully as they might have been?"

Table 4

Summary of Like/Dislike Preferences of the Attendees toward Various Sections of the Exhibit

	A Program on Programed Instruction	B Teaching Machines	C School Usage	D Library of Academic Programs
Like Most (N = 14,612)	29%	32%	7%	32%
Dislike Most (N = 10,740)	15%	34%	33%	18%

Table 5

Summary of Responses of the Attendees to Areas of the Exhibit that were not Adequately Covered

	A Program on Programed Instruction	B Teaching Machines	C School Usage	D Library of Academic Programs	No Response
Inadequate presentation in exhibit area (N = 16,009)	.5%	3%	2%	1.5%	93%

The number of people who responded to the question in Part A was minimal, only 6 per cent. However, both in Part A and Part B the Teaching Machines section was the one most frequently mentioned as not having been adequately covered. On the whole, many of the people wanted to operate rather than to view slides of the machines.

It is our opinion that the reason for their wanting to operate the machines resulted from a basic fear that machines could in fact teach, thereby posing a threat to those viewers in the field of education. Very few indicated an interest in the mechanical capabilities for presenting programed materials; instead, their attitude appeared to be "let me see the other machines in order that I may show you why these machines cannot work?"

In addition, the information presented in the tables in Appendix F gives summary data selected from five sample locations. As with table 3, attendee preferences according to job category, locations did not serve to differentiate the viewing population's attitudes.

The data in toto indicate an extremely favorable attitude toward programed instruction and toward the exhibit in particular. Much anecdotal evidence in terms of letters of approbation and letters requesting further information have been received both by the Center and the Office of Education. These letters are in sufficient number to lead us to vouchsafe the opinion that the data collected have some validity, albeit, replicating data collected at other exhibits, which serve mainly to reflect reactions to the situation rather than to the information.

A further attempt to assess the impact of the exhibit was made by using a follow-up questionnaire. This questionnaire attempted to evaluate the retention of information presented in the exhibit and to determine any action taken on the basis of the visit to the exhibit. We were disappointed in that the response to the questionnaire was so minimal as to be of no value.

XI. Summary

The Demonstration-Exhibit on Programed Instruction and Teaching Machines under contract OE 2-16-031 called for the dissemination of information on programed instruction and teaching machines.

A programed exhibit was constructed based on the principles of programed instruction. The exhibit traveled to forty-four locations and was viewed by over 100,000 people. The majority of the population attending the exhibit consisted of teachers, school administrators, and students who intended to enter teaching as a profession. In all cases, the impressions of the viewing public, as gleaned from the attitude questionnaire, were enthusiastically favorable toward the exhibit.

The information presented in the report tends to support the view that this method of implementing the information dissemination function of the U.S. Office of Education can in fact be a successful one, particularly when considered in terms of the number of people capable of being reached.

APPENDIX A

"A Program on Programed Instruction"

by A. H. Block
D. Mosenfelder

Panel #1

Have you ever worked through a program or used a teaching machine?
No/Yes

Panel #2

"People learn by doing...." What will you be doing in this program? Among other things, answering many, many questions. How does our program attempt to insure your active participation?

a. by uninterrupted discussion
b. by posing questions

Panel #3

Answer to frame 2: b. by posing questions

Questions--questions--questions. The worth of a program depends largely upon its questions. They appear regularly within almost every program item or "frame."

Here is a very easy sample frame:
(Mentally fill in the blank in the last sentence below)

A program is a collection of items called frames.
You are now at the end of this program's third
_____.

Panel #4

Answer to frame 3: frame (or item)

Read through the adjacent program frames. Each of these frames teaches something, then asks a question. The question should test the reader on what he has learned. One frame contains a question that doesn't do this. (Choose a,b,c,d,e, or f)

a. Grammar
"Eggs are edible" is a good English sentence. Does every good sentence contain an article (a, an, or the)? Yes/No

b. Civics
The U.S. legislature consists of the Senate and the House of Representatives. It contains _____ (how many) divisions.

c. Geography
A peninsula is a body of land surrounded on three sides (but not the fourth) by water. Shade in the peninsula on the map below.

d. Arithmetic
$3^2 = 3 \times 3 = 9$
$5^2 = 5 \times 5 = 25$
$4^2 =$ x =

e. Physics
In the preceding frames we have developed a formula for acceleration. Compose an accurate sentence using the words: time, acceleration, change, velocity.

f. Chemistry
Water is composed of hydrogen and oxygen.
What is air composed of?

Panel #5

Answer to frame 4: the question in f. is clearly irrelevant

The frame below does not really test what has been taught either. The question is relevant for a special reason. What is this reason? (from a program of solving equations)

$x - 3 = 8$
add 3 to both sides
$x - 3 + 3 = 8 + 3$
$x = 8 + 3$
$x = ?$

Panel #6

Answer to frame 5: The question tests only the student's ability to add, not his ability to solve such equations.

A good frame question must be relevant. It must also be challenging. The task in the frame below is trivial because the frame contains an unnecessary cue. What is the cue?

In an atom negatively charged electrons orbit around positively charged protons. Put a minus (-) in the electron in this diagram.

more . . .

Panel #7

Answer to frame 6: There is only one choice; the proton has already been labeled by a (+).

Before you go on to the whole sequence of frames above, read this statement.

> Occlusion of a coronary blood vessel, if prolonged, causes damage to the heart muscle, or myocardium. The medical term for myocardial damage produced by occlusion of a coronary blood vessel is myocardial infarction.

1. Myocardial infarction is the medical term for damage to the heart muscle, or myocardium. Which part of the word myocardium means heart? _____ cardium
Which part means muscle? _____ myo

2. "Myocardium" is the medical term for _____ _____. heart muscle

3. Damage to the myo_____ results from occlusion or blockage of a coronary blood vessel. cardium

4. Oc_____, or blockage of a coronary blood vessel, if prolonged, causes damage to the _____. occlusion
myocardium or heart muscle

5. Myocardial infarction, due to o_____ (which means blockage) of a coronary blood vessel is called _____al infarction. occlusion
myocardial

6. Myocardial _farction is the technical term for damage to the _____. infarction
heart muscle or myocardium

7. Occlusion of the coronary artery is one of the possible causes of _____ inf_____. myocardial infarction

8. _____ _____ is the medical term for damage to the myocardium caused by _____ of a _____ _____. myocardial infarction
occlusion; coronary artery

9. Define the term myocardial infarction
damage to the myocardium caused by occlusion of a coronary artery.

more. . .

Panel #8

Now, another short program fragment. Note that the program, like a teacher, proceeds in a logical fashion. It explains operations, requires their use, reviews, and finally tests.

Can you multiply 55 by 55 mentally in about five seconds? 45 x 45? 95 x 95? Most people can't. Here is how you can teach yourself to do it.

1. Here is how you can multiply 45 x 45
   Between which two multiples of 10 does 45 lie? 40 and 50
   Multiply these two numbers 40 x __ = 2000
   Add 25 to the product __ + __ = 2025

2. Here is how you can multiply 75 x 75
   Between which two multiples of 10 does 75 lie? 70 and __
   Multiply these two numbers __ x 80 = ____
   Add 25 to the product __ + __ = ____

From now until the end of the program, any time you feel you can multiply 95 x 95 or 55 x 55 mentally, try the last question. Otherwise go on to the next question.

3. Here is how you can multiply 35 x 35
   Do the steps mentally
   Between which two multiples of 10 does 35 lie? __ and 40
   Multiply these . . . _____
   Add 25 . . . _____

4. Here is how you can multiply 85 x 85
   Do the steps mentally
   Between which two multiples of 10 . . . __ and __
   Multiply . . . _____
   . . . . _____

5. Here is how you can multiply 15 x 15
   Do the steps mentally
   Between which . . . __ and __
   . . . . _____
   . . . . _____

6. Multiply 65 x 65 mentally
   Multiply 95 x 95 mentally
   Multiply 55 x 55 mentally

Panel #9

If you want to check this, multiply 45 x 45 the long way.

more . . .

Your answer should be 5625
Your answer should be 1225
Your answer should be 7225
Your answer should be 225
Answer: 4225
Answer: 9025
Answer: 3025

For your feat of mental multiplication you were taught to follow three steps. You were always given more hints to help you follow one of these steps than the other two. Which step: 1, 2 or 3? Would you have done this step last or first?

Panel #10

Answer to frame 9: Step 1. It is taught last because finding the number between two multiples is a less familiar task than multiplication or addition. There is also a technical reason. Surprisingly, it is more efficient to teach such operations as the one above in reverse order, the first step last.

Those who felt themselves ready were allowed to skip from frame 2 to the test questions in this. When programs allow such a choice, they are said to branch.

Has our exhibit on programed instruction contained a branch? Yes/No

Panel #11 and #12

Answer to frame 10: Yes, a branch at the beginning directed viewers to other sections of the exhibit.

Thus far, have we said anything about teaching machines? Yes/No

Answer to frame 11: No

Teaching machines are devices for regulating the presentation of programs. Programs can teach in the absence of teaching machines. Can the machines teach in the absence of programs? Yes/No

Answer to frame 12: (viewer is requested to push button illuminating the various parts of a machine) No.

more . . .

Panel #13

A program can be tailored to fit students' needs.

example:

In a trial run through a grammar program, many students answered "became larger" to this frame exercise:

The antonym of increase is ----------

The program was revised to include new material teaching the meaning of "antonym." Question:

Suppose several other readers had answered the frame exercise with "outcrease." What revision would have been in order?

Panel #14

Answer to frame 13: The inclusion of new material teaching the meaning of the words "increase" and "decrease." These readers apparently understood the meaning of "antonym."

The reader of a social studies program answered "yes" to this frame question:

Is England a republic or a constitutional monarchy?

How might the question be revised?

Panel #15

Answer to frame 14: One possibility is the following:
(Choose a. or b. below)

a. a republic
b. a constitutional monarchy

In still another way the program adjusts to the needs of the students. It allows them to proceed at their own pace. You are now on frame 15. Another viewer may have taken just as long to get to frame 9. Does self-pacing make a program more like a classroom teacher instructing many students simultaneously or a tutor instructing one student at a time? classroom teacher/tutor

Panel #16

Answer to frame 15: tutor

Let's review some of the things we have said about programs.

a. They ask large numbers of carefully constructed questions.
b. Their presentation is orderly and logical.

more . . .

c. Because of the ongoing record of student responses, they can be revised to meet student needs.
d. Like a tutor, they allow the student to proceed at his own pace.

Question: How many of these items do you think you could have listed?

Panel #17

Answer to frame 16: Probably not all of them. We have thrown a lot of ideas and words at you in rapid succession. In the usual programed learning procedure you would have had ample time to digest everything that was being taught.

Has this program helped you to understand programed instruction? Do you think that this method of instruction can teach and teach effectively? By the way can you multiply 65 x 65 mentally? And what is the definition of the term "myocardial infarction?"

Panel #18

Answer to frame 17: We hope our discussion has been meaningful.
65 x 65 = 4225
Myocardial infarction is damage to the myocardium caused by occlusion of a coronary vessel.

Our exhibit contains three other sections. What would you like to see first?

Library of Academic Programs
School Usage of Programed Instruction
Teaching Machines

APPENDIX B

List of Teaching Machines Displayed on Slides

Audio-Graph
Graflex, Inc.

Auto-Instructor
J. E. Larsen

Autoscore
Astra Corporation

AutoTutor Mk 11
U.S. Industries

Didak 501
Rheem Califone Corporation

Ferster Tutor
Programed Teaching Aids

Forlinger Teaching Machines
Programed Teaching Aids

Jensen Tutor
Dr. Gerald Jensen

Koncept-O-Graph
Graflex, Inc.

Mast Teaching Machine
Mast Development Company

Mesotutor
U. S. Industries, Inc.

Micro-Aid
Graflex, Inc.

Min/Max
TMI-Grolier

Min/Max with Answer Mate
TMI-Grolier

MTA 100 Scholar
Modern Teaching Associates

Professor Spin Model 23
Spinascope Laboratory

Program-Matic
Division of Colortone Press

Redi-Tutor with Tutor-Rite
Du Kane Corporation

Star
MRB Singer, Inc.

Student Tutor Teaching Machines
General Education, Inc.

Teachall
Publisher's Company

Teleguide
LaBelle Industries

Tutorule
Instructive Devices

The Williams Science Desk
Williams Research Corporation

Final Report to Contract OE 2-16-031

APPENDIX C

List of Participating Publishers

Accelerated Instruction Methods Corporation
Addison-Wesley Publishing Company, Inc.
Allen, Dr. Laymon E.
Appleton-Century-Crofts, Inc.
Astra Corporation
Basic Systems, Incorporated
California Test Bureau
Central Scientific Company
Chandler Publishing Company
Coronet Instructional Films
Denver Public Schools
Doubleday & Company, Inc.
Educational Developmental Laboratories, Inc.
Electronic Teaching Laboratories
Encyclopaedia Britannica Press
Entelek, Incorporated
Fearon Publishers, Inc.
Field Enterprises Educational Corporation
General Education, Inc.
Graflex, Inc.
Harcourt, Brace & World, Inc.
Harper & Row Publishers, Inc.
D. C. Heath & Company
Holt, Rinehart & Winston, Inc.
International Educational Service
Jensen, Dr. Gerald
Larsen, Dr. John E.
Learning, Incorporated
Macmillan Company
Marty, Dr. Fernand
Matrix Corporation
McGraw-Hill Book Company, Inc.
NATEC Publications
Prentice-Hall, Inc.
Roto-Vue
Science Research Associates, Inc.
Teaching Materials Corporation
Training Systems, Inc.
Universal Electronics Laboratories
D. Van Nostrand Company, Inc.
Van Valkenburgh, Nooger & Neville
Varian Associates
Franklin Watts, Inc.
Webster Publishing Company
John Wiley and Sons, Inc.
Young, Dr. Jay A.

APPENDIX D

Attitude Questionnaire

QUESTIONNAIRE

Before you leave the exhibit, we should appreciate your filling out the brief questionnaire below and depositing it in one of the boxes marked "QUESTIONNAIRE." These boxes are placed at all of the exits.

I. First of all, which sections of the exhibit did you visit? Place a check (√) in the appropriate box under YES or NO for each section listed below.

	YES	NO
A. A Program on Programed Instruction		
B. Teaching Machines		
C. The Use of Programed Instruction in the Schools		
D. Library of Academic Programs		

II. What were your impressions of the sections of the exhibit that you visited? Place a check in the appropriate box on each line below.

	Extremely favorable	Favorable	Neutral	Unfavorable	Extremely unfavorable
A. A Program on Programed Instruction					
B. Teaching Machines					
C. The Use of Programed Instruction in the Schools					
D. Library of Academic Programs					

(Questionnaire continued on next page)

Please turn along perforated line.

III. A. What part of the exhibit did you like most?

(Answer) _____

B. Least?

(Answer) _____

IV. A. In your opinion, are there any phases of programed instruction that were not covered, but should have been?

(Answer) _____

B. In your opinion, are there any phases of programed instruction that were not covered as fully as they might have been?

(Answer) _____

V. If you are employed in education, please check the appropriate category listed under A, below. If not, please specify your principal occupation, under B, below.

A. Educational Occupation

_____ 1. Teacher, elementary school

_____ 2. Teacher, junior high school

_____ 3. Teacher, high school

_____ 4. Teacher, college, professional or graduate school

_____ 5. School administrator

_____ 6. School psychologist or counselor

_____ 7. Other educational occupation

(specify) _____

B. Principal occupation (not in education)

(specify) _____

Please go on to next page

APPENDIX E

Exhibit Tour Sites

Date	Sponsor	City
October 22, 1962	Headquarters, U.S. Office of Education	Washington, D.C.
November 1, 1962	Department of Classroom Teachers, N.E.A.	Louisville, Kentucky
November 26, 1962	Western Reserve University	Cleveland, Ohio
December 11, 1962	Maxwell Air Force Base	Montgomery, Alabama
December 17, 1962	Louisiana State University	New Orleans, Louisiana
December 27, 1962	Commonwealth of Pennsylvania, Department of Education	Harrisburg, Pennsylvania
January 4, 1963	Teachers College, Columbia University	New York, New York
January 14, 1963	State University of New York	Buffalo, New York
January 29, 1963	Public Schools of Pittsfield	Pittsfield, Massachusetts
February 9, 1963	University of Pittsburgh	Pittsburgh, Pennsylvania
February 20, 1963	Public Schools of Portland	Portland, Oregon
February 26, 1963	American Association of Junior Colleges	Seattle, Washington
March 4, 1963	Association for Higher Education	Chicago, Illinois
March 11, 1963	Purdue University	Lafayette, Indiana
March 18, 1963	North Central Association of Colleges and Secondary Schools	Chicago, Illinois
March 26, 1963	Polk County Board of Education	Des Moines, Iowa
March 30, 1963	Department of Elementary School Principals, N.E.A.	Oklahoma City, Oklahoma
April 4, 1963	Department of Classroom Teachers, N.E.A.	Milwaukee, Wisconsin
April 9, 1963	Montana State Department of Public Instruction	Billings, Montana
April 16, 1963	University of Wyoming	Laramie, Wyoming
April 19, 1963	University of Colorado	Boulder, Colorado
April 22, 1963	DAVI Convention	Denver, Colorado
April 27, 1963	National School Boards Association	Denver, Colorado
May 3, 1963	California Teachers Association	Burlingame, California
May 7, 1963	San Jose State College	San Jose, California
May 14, 1963	University of California	Los Angeles, California
May 27, 1963	Public Schools of Newton	Newton, Massachusetts
June 4, 1964	State Department of Education	Albany, New York
June 12, 1963	Institute for Education by Radio-TV	Columbus, Ohio
June 19, 1963	State University of New York	Oswego, New York
June 25, 1963	Wayne State University	Detroit, Michigan

more. . .

July 9, 1963	Michigan State University	East Lansing, Michigan
July 14, 1963	American Library Association	Chicago, Illinois
July 20, 1963	University of Toledo	Toledo, Ohio
July 25, 1963	Indiana University	Bloomington, Indiana
July 31, 1963	American Teachers Association	Dallas, Texas
August 8, 1963	George Peabody College for Teachers	Nashville, Tennessee
September 25, 1963	University of Illinois	Urbana, Illinois
October 3, 1963	Indiana State College	Terre Haute, Indiana
October 7, 1963	Ohio State University	Columbus, Ohio
October 22, 1963	University of Texas	Austin, Texas
November 5, 1963	Houston Independent School District	Houston, Texas
November 19, 1963	Jackson State College	Jackson, Mississippi
November 25, 1963	University of Georgia	Athens, Georgia

APPENDIX F

Samples of Summary Data from Five Tour Sites

Louisiana State University, New Orleans, Louisiana N = 2132

		Extremely Favorable	Favorable	Neutral	Unfavorable	Extremely Unfavorable
A	Program on Programed Instruction	27.0	52.3	17.3	2.8	.4
B	Teaching Machines	22.5	44.3	22.3	9.3	1.6
C	Use of Programed Instruction in Schools	20.4	41.9	30.9	5.8	1.0
D	Library of Academic Programs	32.2	45.1	19.3	2.8	.6

III. A. What part of the exhibit did you like most?

A	B	C	D
Program on Programed Instruction	Teaching Machines	School Usage	Library of Academic Programs
24.6	30.2	9.7	32.5

B. What part of the exhibit did you like least?

A	B	C	D
Program on Programed Instruction	Teaching Machines	School Usage	Library of Academic Programs
18.7	31.2	29.5	20.6

more . . .

Buffalo State University, Buffalo, New York N = 492

		Extremely Favorable	Favorable	Neutral	Unfavorable	Extremely Unfavorable
A	Program on Programed Instruction	30.5	50.8	15.3	2.6	.8
B	Teaching Machines	20.6	45.8	24.4	6.7	2.5
C	Use of Programed Instruction in Schools	18.8	42.2	33.3	4.9	.8
D	Library of Academic Programs	32.4	45.2	20.6	.9	.9

III. A. What part of the exhibit did you like most?

A	B	C	D
Program on Programed Instruction	Teaching Machines	School Usage	Library of Academic Programs
30.3	31.4	7.4	30.9

B. What part of the exhibit did you like least?

Program on Programed Instruction	Teaching Machines	School Usage	Library of Academic Programs
15.2	32.4	32.2	20.2

more . . .

University of Pittsburgh, Pittsburgh, Pennsylvania N = 1024

		Extremely Favorable	Favorable	Neutral	Unfavorable	Extremely Unfavorable
A	Program on Programed Instruction	30.5	48.4	17.6	2.2	1.0
B	Teaching Machines	24.7	40.3	22.3	9.1	1.6
C	Use of Programed Instruction in Schools	20.7	45.8	26.8	5.5	1.2
D	Library of Academic Programs	32.3	45.1	19.0	3.0	.6

III. A. What part of the exhibit did you like most?

A Program on Programed Instruction	B Teaching Machines	C School Usage	D Library of Academic Programs
30.0	32.1	6.2	31.7

B. What part of the exhibit did you like least?

A Program on Programed Instruction	B Teaching Machines	C School Usage	D Library of Academic Programs
15.3	32.0	33.7	19.0

more . . .

Purdue University, Lafayette, Indiana N = 256

		Extremely Favorable	Favorable	Neutral	Unfavorable	Extremely Unfavorable
A	Program on Programed Instruction	28.8	50.0	19.0	2.0	.2
B	Teaching Machines	26.9	40.3	23.0	8.8	1.0
C	Use of Programed Instruction in Schools	23.8	44.1	25.4	6.0	.7
D	Library of Academic Programs	30.0	43.7	20.3	3.5	1.5

III. A. What part of the exhibit did you like most?

A Program on Programed Instruction	B Teaching Machines	C School Usage	D Library of Academic Programs
29.3	30.3	9.7	30.7

B. What part of the exhibit did you like least?

A Program on Programed Instruction	B Teaching Machines	C School Usage	D Library of Academic Programs
15.5	30.0	35.8	28.7

more . . .

University of Texas, Austin, Texas N = 1428

		Extremely Favorable	Favorable	Neutral	Unfavorable	Extremely Unfavorable
A	Program on Programed Instruction	27.4	53.4	15.9	2.6	.7
B	Teaching Machines	24.7	39.8	25.1	8.8	1.6
C	Use of Programed Instruction in Schools	20.2	46.3	25.7	6.3	1.5
D	Library of Academic Programs	32.6	43.5	20.5	2.5	.9

III. A. What part of the exhibit did you like most?

A Program on Programed Instruction	B Teaching Machines	C School Usage	D Library of Academic Programs
34.7	30.3	8.0	27.0

B. What part of the exhibit did you like least?

Program on Programed Instruction	Teaching Machines	School Usage	Library of Academic Programs
16.4	32.8	32.4	18.4